

component.

[c9] The method of claim 1, wherein the acquiring uses a pulse sequence comprising an inversion recovery sequence and a Carr-Purcell-Meiboom-Gill sequence.

[c10] The method of claim 9, wherein the acquisition parameter comprises one selected from the group consisting of a recovery time RT in the inversion recovery sequence, a polarization time WT , and an inter-echo delay TE in the Carr-Purcell-Meiboom-Gill sequence.

[c11] The method of claim 9, wherein the model comprises a correlation function for each component in the mixture of fluids, the correlation function relates a measured magnitude, A_i , of the nuclear magnetic measurements with parameters used for the acquiring as follows:

$$A_i = A \left(1 - S * e^{-\pi T / T_1} \right) e^{-\pi T / T_2}$$

where A is a full signal amplitude after full polarization along the static magnetic field, RT is an inversion recovery time in the inversion recovery sequence, TE is an inter-echo delay time in the Carr-Purcell-Meiboom-Gill sequence, T_1 is a longitudinal relaxation time, T_2 is a transverse relaxation time, and S is defined as:

$$S = 1 + IE * \left(1 - e^{-\pi T / T_1} \right)$$

where IE is an inversion efficiency and WT is a polarization time.

[c12] The method of claim 1, wherein the acquiring uses a pulse sequence comprising a saturation recovery sequence and a Carr-Purcell-Meiboom-Gill sequence.

[c13] The method of claim 12, wherein the acquisition parameter comprises one selected from the group consisting of a recovery time RT in the inversion recovery sequence, a polarization time WT , and an inter-echo delay TE in the Carr-Purcell-Meiboom-Gill sequence.

[c14] The method of claim 1, wherein the acquiring comprises:
inducing a static magnetic field in a region of investigation;
generating a series of radio frequency magnetic field pulses in the region of investigation, the series of radio frequency magnetic field pulses comprise an inversion recovery pulse sequence and a Carr-Purcell-Meiboom-Gill pulse

sequence; and
 receiving signals comprising a train of nuclear magnetic resonance spin echoes,
 wherein a polarization time between the series of radio frequency magnetic field
 pulses is WT, an inter-echo delay in the Carr-Purcell-Meiboom-Gill pulse
 sequence is TE, a recovery time in the inversion recovery pulse sequence is RT,
 and the generating and the receiving are repeated a plurality of times each with
 a different value in at least one parameter selected from the group consisting of
 WT, TE, and RT.

- [c15] The method of claim 1, wherein the acquiring comprises:
 inducing a static magnetic field in a region of investigation;
 generating a series of radio frequency magnetic field pulses in the region of
 investigation, the series of radio frequency magnetic field pulses comprise a
 saturation recovery pulse sequence and a Carr-Purcell-Meiboom-Gill pulse
 sequence; and
 receiving signals comprising a train of nuclear magnetic resonance spin echoes,
 wherein a polarization time between the series of radio frequency magnetic field
 pulses is WT, an inter-echo delay in the Carr-Purcell-Meiboom-Gill pulse
 sequence is TE, a recovery time in the saturation recovery pulse sequence is RT,
 and the generating and the receiving are repeated a plurality of times each with
 a different value in at least one parameter selected from the group consisting of
 WT, TE, and RT.
- [c16] The method of claim 3, further comprising (f) deriving, from the model, at least
 one porosity selected from the group consisting of water-filled porosity, oil-
 filled porosity, total NMR porosity, free-fluid porosity, and bound-fluid porosity
 of the earth formation.
- [c17] The method of claim 3, further comprising (f) deriving, from the model, at least
 one saturation from the group consisting of water saturation and oil saturation
 of the earth formation.
- [c18] The method of claim 3, further comprising (f) deriving, from the model,
 viscosities or diffusion constants of oil constituents of the earth formation.

relaxation time distribution of the oil phase.

- [c24] The method of claim 19, further comprising (h) deriving, from the formation model, at least one porosity selected from the group consisting of water-filled porosity, oil-filled porosity, total NMR porosity, free-fluid porosity, and bound-fluid porosity of the formations.
- [c25] The method of claim 19, further comprising (h) deriving, from the formation model, at least one saturation selected from the group consisting of water saturation and oil saturation of the formations.
- [c26] The method of claim 19, further comprising (h) deriving, from the formation model, viscosities or diffusion constants of oil constituents of the formations.